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THE STRUCTURE AND PROPERTIES OF ALTERNATELY ELECTRODEPOSITED METALS

Summary

Details of this investigation were published in an article by W. Blum in the Trans. Amer. Electrochem. Soc. 40, 137 (1921), and in Chem. Met. Eng. 25, 961 (1921).

Experiments were made a few years ago upon the electrolytic reproduction of engraved printing plates for the Bureau of Engraving and Printing. It was then found by Mr. Geo. U. Rose, Jr., that the introduction of layers of nickel at intervals during the copper deposition, caused the plates to be much stronger, i.e., they would withstand bending more readily than pure copper plates. This process of depositing alternate layers of copper and nickel, which has been patented by Mr. Rose, is employed in the new electrolytic plant of the Bureau of Engraving and Printing, which was designed and installed under the direction of the Bureau of Standards. A brief description of this process was published in Chem. Met. Eng. 25, 330 (1921).

Investigation showed that the introduction of layers of nickel retards the growth of the crystals of copper, and therefore causes the deposit to have a higher tensile strength than copper alone deposited under similar conditions. It was found that the effect of a given proportion of nickel is more pronounced, the more frequently the layers are introduced. By this means it is possible to produce plates containing about 10% of nickel which have a tensile strength of over 41,000 lb./sq.in. as compared with 24,000 lbs. /sq.in. for copper alone deposited under the same conditions.

The introduction of nickel layers also reduces the tendency of the copper to form "trees", and therefore permits the use of higher current densities in the copper deposition than can be otherwise used for the production of thick deposits.

These principles apply to other cases in which two metals, e.g. silver and copper, are deposited in alternate layers. Similar effects can also be produced by means of layers of the same metal deposited from two different types of solutions, e.g. copper from the sulphate and cyanide solutions respectively.

This principle may find application in the formation or reproduction of articles by electrodeposition, such as tubes, phonograph record matrices, etc.